INSTRUCTIONS FOR CONNECTING AND OPERATING

PORTABLE BOVIE

ELECTRO-SURGICAL UNIT

SPARK GAP ADJUSTMENT IS THE MOST IMPORTANT FACTOR IN PLACING BOVIE IN SERVICE. STUDY INSTRUCTIONS CAREFULLY AND ADJUST GAPS EXACTLY AS OUTLINED.

INDEX

THE LIEBEL-FLARSHEIM COMPANY

303 West Third Street

CINCINNATI - - - - OHIO

INSTRUCTIONS FOR CONNECTING AND OPERATING

THE PORTABLE BOVIE ELECTRO-SURGICAL UNIT

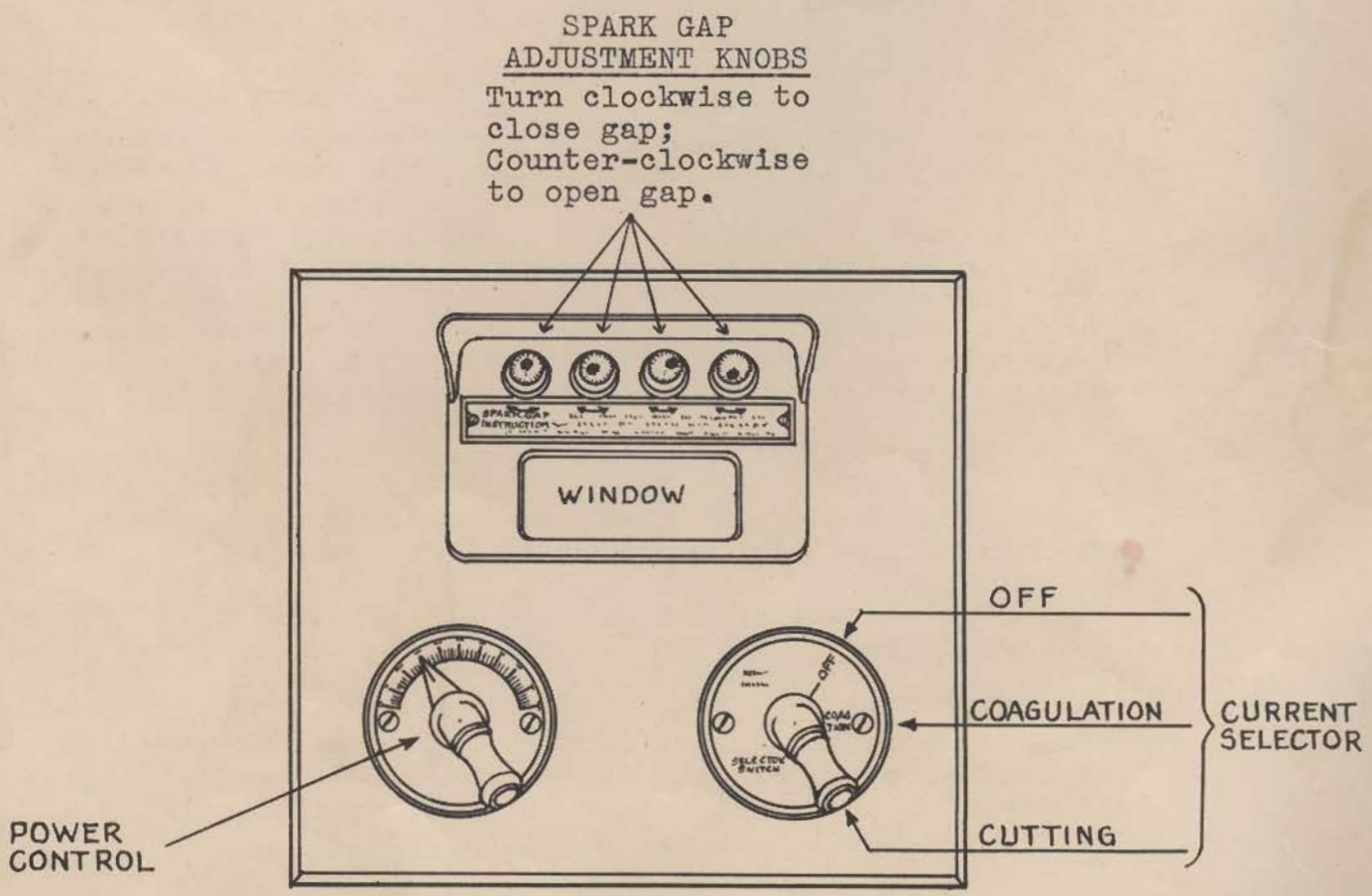
GENERAL DESCRIPTION

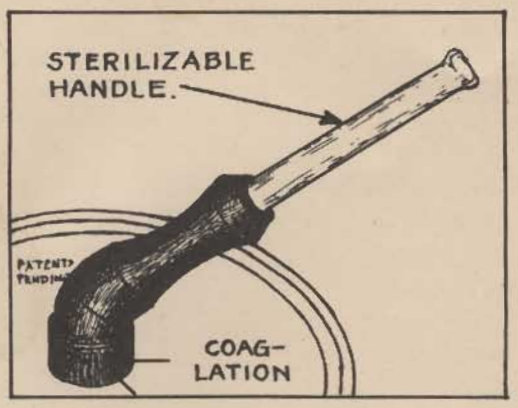
The Bovie Unit generates two distinct surgical currents; 1 - CUTTING; 2 - COAGULATION (Same current used for desiccation and fulguration).

Either current can be instantly connected to the operating electrode by simply placing the manually operated "CURRENT SELECTOR" in proper position as illustrated below. Thereafter the current is turned on and off with the foot switch.

Facing the cabinet, you see above on the top panel the spark gap adjustment knobs and immediately below, the glass window through which gaps can be seen.

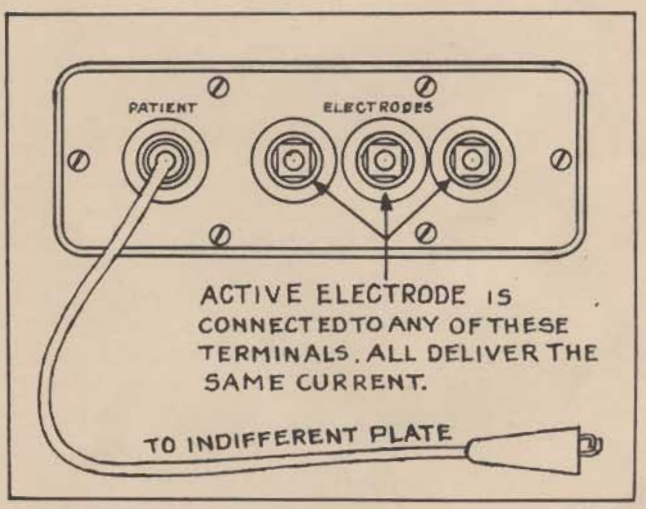
Below this window, to the left, is a single control that governs the power of either current. This control, moving through its graduated scale, varies the power of the current in use from zero up to maximum output. To the right is the CURRENT SELECTOR which also serves as a MAIN SWITCH.





STERILIZABLE HANDLES are provided for the selector switch and the power control. When the machine is used for major surgery these handles should be sterilized by boiling or autoclaving and inserted in openings in the power control and selector switch, thus permitting all necessary manipulations under aseptic conditions. Two or three clockwise turns will lock sterilizable handle in place.

HIGH FREQUENCY CONNECTIONS. On the front panel are four terminals of the "plug-in" type. The single connection marked "PATIENT" is for the "indifferent" electrode. The three connections labeled "ELECTRODES" are for active (operating) electrodes.... These three active terminals all deliver the same current -- they are provided in multiple so that up to three different instruments (required in certain operations) can be connected simultaneously, and, while operating, the surgeon can simply pick up the electrode needed at the moment. Inactive electrode cord is equipped with a round plug; active electrode with square plug so they cannot be connected to the wrong terminal. If more than one active electrode is connected, it must be remembered that all are "alive" whenever current is turned on and precautions taken to avoid accidental contact with those not in use.



Immediately below outlet panel is the pilot light which glows when selector switch is on "Cutting" or "Coagulation" position. However, no high frequency current is generated until the foot switch is depressed.

On the back of the cabinet are connections for the electrical current (marked "Supply Plug") and for the "Foot Switch".

At back of sub-cabinet is an open compartment for convenient storage of foot switch and supply cable. At upper left corner of sub-cabinet is a small metal bracket which supports the sterilizable instrument rack.

STERILIZABLE INSTRUMENT RACK consists of four separate pieces, the rack proper and three sections of supporting standard, two straight sections and one curved at each end. When used for major surgery this entire rack assembly may be sterilized by boiling or auto-claving and fastened to the machine as illustrated.The section inserted in bracket should be fastened with set screw. If the instrument rack is too high for convenience with both straight sections in place, leave off one length, or both.

TO PLACE MACHINE IN OPERATION

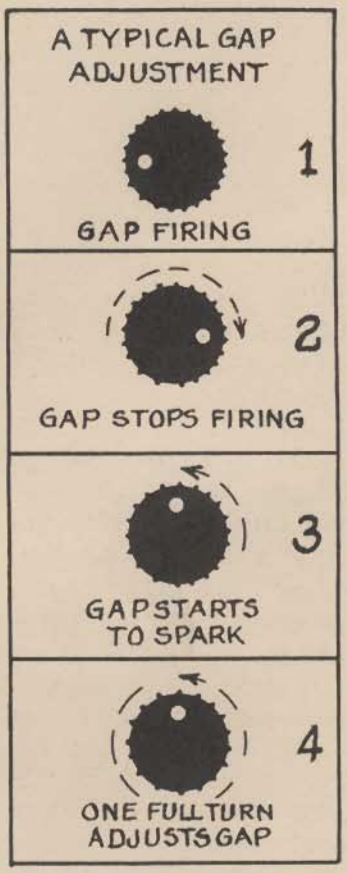
To place the Bovie Unit in service requires merely that the supply cable and foot switch be connected, the spark gaps correctly adjusted,the patient and active electrodes connected and the power control properly set. These steps are covered in detail in the following.

1. CONNECT SUPPLY CABLE AND FOOT SWITCH to proper terminal on back of cabinet. Be sure the machine is connected to supply current of proper voltage and frequency. Unless otherwise noted on name plate, the Bovie is designed for operation on 115 volts, 60 cycles alternating current. Special models which operate on other alternating currents are so marked on the name plate. When only direct current is available a rotary converter must be used. Make sure that the fuses on your supply line are heavy enough to carry the machine in addition to any other load that may be on the line at the same time.The Portable Bovie requires fourteen amperes at 115 volts or seven amperes at 230 volts. Consult your electrician and see that fuses of adequate capacity are installed before machine is put in use.

2. ADJUST SPARK GAPS.Firing of the gaps may be observed through the glass window.Immediately above each gap is its adjustment knob. Turning the knob clockwise closes the gap; counter clockwise opens the gap.

As current quality is dependent on spark gap adjustment, it is essential that this operation be accurately and properly performed.There is nothing difficult about the gap adjustment -- on the contrary, it is a rather simple procedure -- but it must be done just right to insure satisfactory performance.

TO ADJUST GAPS, first move selector switch to either the "Scalpel" or "Coagulation" position. Step on foot switch to start current flow through gaps. Then look at the gaps through observation window.If any of the gaps are not firing, turn the proper adjusting knob (or knobs)counter-clockwise to open the gaps slightly until all start to fire. It is essential that all gaps be firing prior to adjustment. IF UNABLE TO MAKE ALL GAPS FIRE, SEE FOLLOWING SECTION, PAGE 7



1- After all gaps are firing,take each individual gap(for example,start at left and work to right), carefully align your eye with the gap being adjusted and

2- Turn its adjustment knob CLOCKWISE until it stops firing

3- Slowly turn knob COUNTER-CLOCKWISE until you see the gap start to spark THEN STOP!--------and note position of small white dot on knob.

4- From the point where continuous sparking was first observed, TURN KNOB COUNTER-CLOCKWISE ONE FULL TURN, which will put that particular gap in proper adjustment.

ADJUST ALL GAPS IN THIS MANNER.

It is important that the observer's eye be lined up directly with the sparking surface on gap being adjusted. The best way is to close one eye, and moving the head laterally in front of the gap,stop at the point where firing seems most intense. The arc that takes place is quite small and, if viewed from even a moderate angle, you may not see the first sparking in the gap from which point the subsequent one turn counter-clockwise adjustment must be made.

For safety, the gap adjustment should be made each time before an operation is started. While the gaps will, under ordinary conditions, retain their adjustment over quite a period of time, if the machine is moved around or jolted they may get slightly out of adjustment and for safety and assurance of satisfactory performance we recommend a complete gap adjustment each time before starting to work.

When correctly adjusted, intensity of the arc in each gap should appear about the same to the eye.If a particular gap appears to fire with less intensity than the others, it probably means that it has not been opened enough and should be completely readjusted in accordance with above instructions.

If any one gap fires irregularly or sputters, it very likely means that the gap needs readjustment because it has been opened too wide.

With the gaps properly adjusted you will hardly hear the arc that takes place when current is on. (Don't confuse the 60 cycle transformer hum with the high pitched hissing note of the arc). If one or more of the gaps are opened too wide, or if they are adjusted improperly so that one takes most of the load, there will be a decided sputtering in that one gap(or all gaps,if all are open too much). The sputter can be seen and its crackling sound is distinctly heard. A single sputter at rare intervals is of no consequence, but if heard often or continuously, all gaps should be correctly adjusted.

We have elaborated on this spark gap adjustment, not because it is difficult or complicated, but rather on account of its relative importance. Correct gap adjustment is essential to satisfactory operation, particularly of the cutting current. If the machine seems to lack cutting power -- if it cuts slowly -- or if there is an excessive amount of dehydrated tissue on edges of the wound -- these are sure signs that the gaps are not in adjustment and they should be properly set before further use.

Remember these simple instructions;

HAVE ALL GAPS FIRING BEFORE THE ADJUSTMENT IS STARTED.

HAVE THE EYE LINED UP DIRECTLY WITH SPARKING SURFACE and catch the point where firing first begins.This is a critical factor in the adjustment. You must see the very first continuous twinkle and then open the gap one full counter-clockwise turn from the point where firing was first observed.

ADJUST ALL GAPS EACH DAY BEFORE WORK IS STARTED.

These Bovie gaps incorporate a unique, patented, self-compensating feature which insures their continuous, satisfactory operation and consistent performance. When properly adjusted, the machine is brought to a condition of stability and, under equivalent conditions, results can always be duplicated -- you know in advance the results to be expected from a given power setting.

IF UNABLE TO MAKE GAPS FIRE

1. Occasionally some uninformed persons may start to "play" with the machine and close one or more gaps several turns or open them up a number of turns. If this occurs it may appear impossible to get the gaps to fire. Fortunately there is a simple remedy for this seemingly perplexing condition.

The thing to do is first, close all gaps completely by turning each adjustment knob clockwise until resistance is felt and further motion arrested. This may require anywhere from two or three to thirty or more turns, depending on whether gap is partially open or closed at the start. Stops limit the number of possible turns in either direction and considerable resistance will be felt when this limit is reached. Don't attempt to turn knob BEYOND POINT WHERE RESISTANCE IS FELT. To do so might damage gap mechanism.

After all gaps are completely closed -- after all knobs have been turned clockwise until resistance is felt -- then open one gap at a time until it starts firing. This will require from fifteen to twenty-five counter-clockwise turns. Then open the other gaps in same manner until all are firing. After all gaps have started to fire they should be correctly adjusted in accordance with instructions in preceding section.

2. Make sure that machine is connected to correct current supply.

3. Make sure that the supply line is not "dead" because of burned out fuses or other reasons.

4. See that the foot switch is connected.

5. See that current selector is on "Scalpel" or "Coagulation" position.

Pilot light will glow when machine is connected to proper current supply and selector switch on "Scalpel" or "Coagulation" position. If pilot light does not glow, look for trouble in your supply line.

* * * * * * * * * * * *

With the supply cable and foot switch connected and gaps properly adjusted, the machine is ready for service and you can;

CONNECT INDIFFERENT ELECTRODE to the one terminal marked "Patient", using a cord with clip on one end and round plug on other. The clip is fastened onto the metal indifferent plate. (See subsequent section for further information on applying indifferent electrode.)

WHEN USED FOR ASEPTIC SURGERY the various parts that require touching or handling during operation should be sterilized before they are connected. These include the sterilizable instrument rack, the electrode holders with their cords, and the required operating electrodes. (See subsequent section on methods of sterilization)

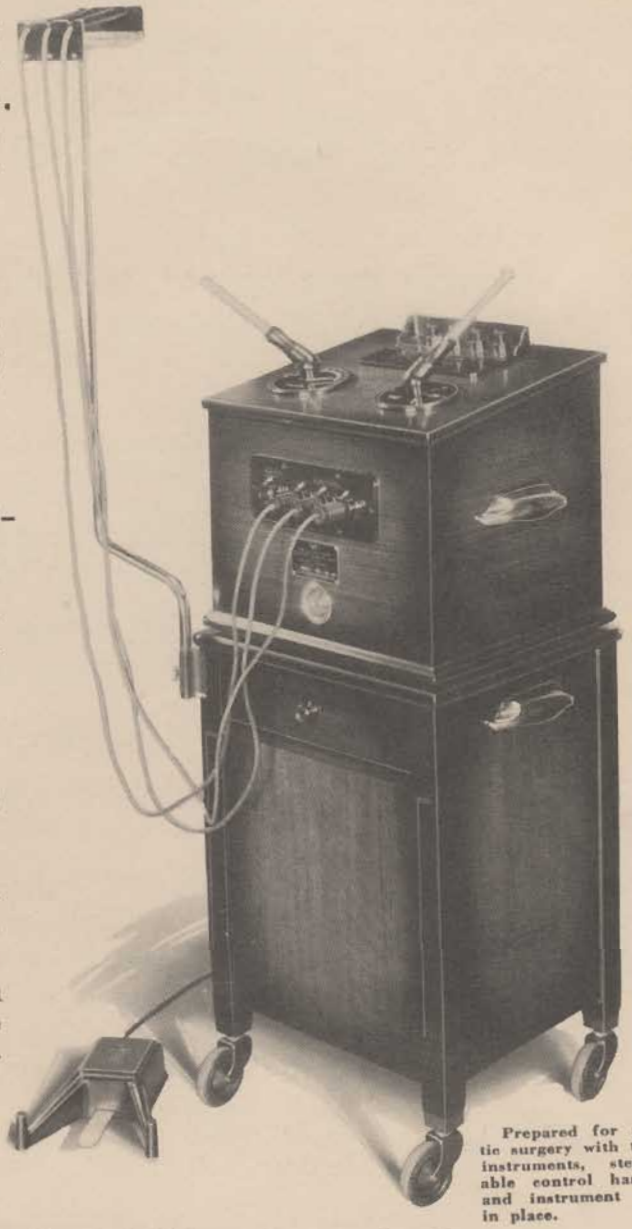
With these parts sterilized you are ready to;

INSERT STERILIZABLE HANDLES in openings in the power control and selector switch. Turn handle two or three clockwise turns to lock it in place.

INSERT OPERATING ELECTRODES in handles by unscrewing to release the chuck, inserting electrode and then tightening chuck carefully.

INSTALL STERILIZABLE INSTRUMENT RACK as illustrated. If instrument rack is too high for convenience with both straight sections in place, merely leave off one length, or both.

CONNECT OPERATING ELECTRODE HANDLES to any of the three terminals marked "Electrode" All deliver the same current. One, two or three handles may be connected as required. Lay handles with their instruments in place on the sterilizable instrument rack.



Prepared for aseptic surgery with three instruments, sterilizable control handles and instrument rack in place.

With all connections made the machine is ready for service with the exception of power control adjustment. This is covered at length in the following section.

POWER CONTROL SETTINGS FOR ELECTRO-CUTTING

The single control at left front on top panel varies the power of the cutting and coagulation currents. This control is effective when either current is turned on.

Rotating through its graduated scale, it affords a constant, unbroken range of power from zero up to maximum output of the current in use. The scale is purely arbitrary, indicating the relative current strength between minimum and maximum settings.

The amount of power required for any given type of work -- either cutting or coagulation --involves a number of variables so that in the end, experience and familiarity with the machine and different electrodes will be of more value than any arbitrary figures we may set. However, if the fundamentals are thoroughly understood, the operator will, with a little experience, have no difficulty in arriving at the correct settings to use under different conditions.

First, let us consider the various factors that influence the power requirement for electro-cutting.

CUTTING POWER REQUIRED IN GENERAL SURGERY will vary, depending on -

A-Nature of tissue being sectioned. Fatty tissue or cartilage requires more power than skin or muscle tissue. Sclerotic, fibrotic or cicatrical tissue will require more power than softer structures.

B-Depth of incision. A deep incision(with the same electrode and a given speed of cut) requires more power than a shallow one.

C-Rate of speed at which cutting electrode is moved; fast cuts require more power than slow.

D-Type of electrode used. For a given depth of incision with equivalent speed of cutting, the amount of power required will depend on the thickness of the electrode used. The thinner the electrode the less power required.

With these fundamentals in mind, it can be seen that the power settings are not fixed arbitrary figures, subject to no variation. Rather, the surgeon should learn that this is a flexible factor and that best results are secured by varying the power settings to meet the immediate conditions.

There is one safe general rule that applies to all conditions, namely,

USE THE LOWEST POSSIBLE POWER SETTING WHICH, WITH THE ELECTRODE IN USE, CUTS FREELY TO THE DESIRED DEPTH.

This rule, if followed, will result in a minimum of sparking and flashing at the electrode --- will prolong the life of operating instruments -- will prevent charring or excessive coagulation of the wound edges.

As noted above, variables prohibit recommending definite power settings for different conditions. These can be learned only by studying performance of the unit on actual operations, under your own conditions. However, it is feasible to give power ranges within which certain results can be secured and the following will serve as a guide in starting out.

Using the small flat blade, a power setting of 25 to 35 will permit fairly rapid incisions through skin or muscle, 1/8" to 1/4" deep.

Settings between 35 and 45 will make rapid incisions up to about 1/2" deep.

From 45 upward will cut the full depth of the small blade.

The above settings apply to the use of the small flat blade. The large flat blade, the small needle, and the large needle require slightly more power in the order named. To cut the full depth of the large blade around 60 will be required. To cut the full depth of the large <u>needle</u> around 65 will be required.

With the smaller loop electrodes around 30 to 35 will "scallop" small bits of tissue. From 45 to 55 will excise fairly large pieces of tissue and for big segments with the larger loop, from 55 upwards will be required.

CERVICAL CONIZATION ELECTRODES will require from 40 to 60 depending on depth the electrode is inserted and size of segment to be removed.

DR. RALPH C. MATSON'S INTRA-THORACIC ELECTRODES for severing pleural adhesions in artificial pneumo-thorax will require varying power settings depending on the nature of the adhesions and depth of cut. 35 is about the minimum effective setting -- considerably more power will be needed under certain conditions. Small string-like adhesions may require more power than larger ones due to their higher electrical resistance.Cutting power should be varied to suit immediate conditions.

Please recall that the above are not fixed arbitrary figures. They may vary if your line voltage is above or below normal. In a wet, bloody field, considerably more power may be required than in drier tissue. Recall that fatty tissue or cartilage require more power than skin or muscle. As actual work is done, experiments with different amounts of power and through experiments learn those settings that give best results under your particular conditions.Experiments on meat as outlined later are very valuable and are highly recommended before work is started on an actual patient.

NOTE - Electro-cutting should always be done by the bipolar method; that is, a large indifferent electrode should be applied to the patient's bare skin. Under certain conditions it is physically possible for the surgeon to cut without an indifferent electrode, but this is not recommended for general use. For a given depth of incision it requires a great deal more power to cut without an indifferent electrode(monopolar) than it does with the bipolar method. Also, if an indifferent electrode is not used a direct current path is not provided through the patient and there might be a tendency for the current to "leak" out through the operator. For these reasons we recommend that cutting always be done by the bipolar method.The approximate power settings shown above are based on an indifferent electrode being used.

IF MACHINE DOES NOT CUT

The chances for any electrical or mechanical failure on the part of the machine itself are so remote that if, on trial, it apparently will not cut,it is likely that some important point in the preparation has been overlooked. Therefore, in case the machine does not cut properly, check all the following points and be sure;

1. That machine is connected to correct current supply.

2. That current supply is alive. Be sure and have fuses of sufficient capacity on your supply wire to carry the Bovie as well as any other load that may be on the line at the same time.

3. That current selector is on "SCALPEL" position.

4. That all four spark gaps are correctly adjusted and firing with equal intensity,without sputtering or irregular operation.

5. That high frequency cord from operating electrode is connected to the machine. In Prostatic Resection be sure high frequency cord is connected to proper terminal on resection instrument.

6. That indifferent electrode is firmly in contact with Patient's bare skin and connected to the machine.

7. That power control is properly set.

8. In Prostatic Resection, with all the above points checked, if machine still does not cut, it indicates

   A - A defective loop -- change loops immediately, or

   B - That the irrigating medium is of high chemical content. If in doubt,only distilled water should be used.

POWER SETTINGS FOR ELECTRO-COAGULATION AND DESICCATION

For this work current is applied by various methods through electrodes of different sizes and shapes so that an understanding of the different conditions is necessary before power settings can be worked out.

ELECTRO-COAGULATION can be defined as a process in which a high frequency current is employed to actually "cook" tissue surrounding the active electrodes. Enough heat to do this is generated within the tissue by the current passing from the electrode into the surrounding tissue.

ELECTRO-DESICCATION is a procedure similar to electro-coagulation except that active electrode is not placed in actual contact with tissue. Current is allowed to jump through space and, sparking onto the surface being treated, dehydrates the superficial layers of tissue.

These two methods of application produce exactly the same effect on tissue - namely - the cells so treated are dehydrated, or coagulated, or, actually cooked - the difference being that contact coagulation penetrates more deeply, causes a greater depth of destruction -- whereas desiccation affects only the superficial layers.

Both coagulation and desiccation can be done with or without an indifferent electrode. To denote these two conditions the following terms are used:

1 - Monopolar when a single active electrode is used without an indifferent electrode.

2 - Bipolar when an indifferent electrode is used for current return path.

These terms are used merely to indicate the method of applying current. There is no difference in the surgical effect of the current or in their electrical characteristics. The only difference is in the amount of power secured from a given setting. For a given power setting more current is obtained with bipolar applications than with monopolar.

The amount of power required for this work varies widely and depends on:

A. Size of Electrode used.
B. Area of electrode in contact with tissue.
C. Depth and area of destruction desired.
D. Length of time current is applied.

Again, it is not possible to give definite power settings for various classes of work, but the following will serve as a starting point.

MONOPOLAR DESICCATION	-- Very light	-- 10 to 20
	Light	-- 20 to 35
	Medium	-- 35 to 50
	Heavy	-- 50 upward
BIPOLAR COAGULATION	-- Very light	-- 5 to 10
	Light	-- 10 to 20
	Medium	-- 20 to 35
	Heavy	-- 35 upward
BLADDER FULGURATION	-- From 50 upward, depending on size of tip and amount of destruction desired.	

Settings shown above will apply when the current is used for tissue destruction.

For electro-hemostasis by the clamp and coagulation method, power requirements will vary considerably, depending on the size of the clamp used, the amount of tissue picked up, the size of the bleeder and other factors. In general, however, a power setting of around 35 (bipolar method) will prove adequate if only small amounts of tissue are picked up in the clamp and from 40 to 45 if larger clamps are used and larger bits of tissue picked up.

SPECIAL NOTES ON POWER SETTINGS

For

TRANSURETHRAL PROSTATIC RESECTION

As in all electro-surgical work, power settings for resection should be varied to best suit the immediate conditions.

It is always desirable to use the least power that will produce the desired results, i.e.use the lowest cutting power that resects freely on the particular gland being removed. Use the lowest coagulation power that will effectively control hemorrhage,remembering that the larger the bleeding vessel,the more power is required for quick control. The less power used, the longer the loops will last and the less tendency to char and carbonize the sheath.

In general, somewhere within the following power ranges will prove satisfactory.

28 Fr. McCarthy Electrotome --	Cutting Power	- 60 to 85
	Coagulation Power	- 40 to 60
24 Fr. McCarthy Electrotome --	Cutting Power	- 50 to 75
	Coagulation Power	- 30 to 50
Stern-Davis Resectoscope --	Cutting Power	- 60 to 85
	Coagulation Power	- 40 to 60

It may be desirable to change power settings in the course of an operation. When starting to resect it is advisable to use the lower power range and if easier cutting is desired, step up the power a few points at a time until it cuts freely.

For control of hemorrhage a coagulation power setting around 45 will effectively control oozing or bleeding from the smaller vessels, but in the presence of large individual spurters more power (around 55) should be applied for effective, rapid control. Really large bleeders require considerable power for quick control.

STERILIZATION OF ELECTRODES AND ACCESSORIES

In preparing the Bovie Unit for aseptic surgery,all parts which are handled or touched in the course of an operation should be sterilized prior to use. These include the sterilizable instrument rack and its three lengths of supporting standard; operating electrode handles with their cords; the sterilizable glass handles which fit into power control and selector switch; all needles, knives, loops, blades and other operating instruments.

The metal parts, including the entire instrument rack assembly, the loops,needles, knives, etc.,can be sterilized by prolonged boiling or auto-claving without damage.

However, the bakelite handles and rubber cords are subject to some deterioration if subjected to prolonged heat sterilization and they will need replacement from time to time.

The useful life of the handles and cords can be lengthened by sterilization in some adequate cold solution, but we do not recommend cold sterilization in Neuro-surgery, operations in the Thoracic Cavity,in the abdomen,etc. where immaculate conditions are essential.

In several institutions the operating handles and cords are wrapped in towels and sterilized in the autoclave for ten minutes at 20 pounds pressure. This is considered adequate for most major surgery and does not cause undue deterioration of the bakelite and rubber parts.

For Prostatic Resection instruments the customary mercuric cyanide solution used for cystoscopes is recommended. Alcohol or phenol should not be used on the resection instruments as they may cause deterioration of some of the parts.

SERVICE NOTES

The only thing on the Bovie Unit that will ever need special attention is the spark gaps which will require reconditioning after about 500 major operations.This would ordinarily be after three to five years service in an average institution. This is handled on a replacement basis from the factory. The need for gap reconditioning is indicated by a gradual impairment of cutting quality and/or irregular, sputtery gap operation.When this occurs, communicate directly with the Company for detailed instructions.

Other than infrequent gap reconditioning as above noted,the only service or maintenance required will be repairs or replacements of electrodes,handles, and other accessories. Electrodes,handles, and their cords, the supply cable and foot switch cable may need repairs if the wires become frayed or broken.If any of the accessories or cables need repairs, communicate with our nearest representative or direct with the Company.

THIS BOOKLET COVERS PRIMARILY THE MECHANICS OF ADJUSTING AND PREPARING THE BOVIE UNIT FOR SERVICE. THE ACCOMPANYING BOOKLET "THE FUNDAMENTALS OF ELECTRO-SURGERY" CONTAINS A GREAT DEAL OF INFORMATION THAT WILL BE VALUABLE TO THOSE JUST UNDERTAKING ELECTRO-SURGERY. ITS CAREFUL PERUSAL AND A THOROUGH STUDY OF THE REPRINTS ON ELECTRO-SURGERY IS RECOMMENDED BEFORE ACTUAL OPERATIVE WORK IS UNDERTAKEN.